REMARKS

Status of Claims

Claims 3-6 were pending in the application and were subject to restriction to one of the inventions of Group I, claim(s) 4-5, drawn to a crankshaft with combined drive gear wheel, or Group II, claim(s) 3 and 6, drawn to a process.

In response Applicants elected ***Group I, with traverse.***

Accordingly, claims 4-5 are under examination, and claims 3 and 6 are withdrawn.

However, Applicants herewith request reconsideration of the restriction requirement.

Further, to better define the special features of the present invention, new claims have been added. Support for new claims 7-14 can be found in paragraphs [0010] and [0014] of the specification as filed, as well as in original claims 4 and 5 (i.e., separating carbide and peening).

Request for Reconsideration of Restriction Requirement

First, as provided in MPEP §1850, the decision with respect to unity of invention rests with the International Searching Authority or the International Preliminary Examining Authority. A decision has already been mad with respect to unity of invention, and as the claims have not been materially altered. Accordingly, the decision should stand.

The Examiner, while maintaining the restriction requirement, has not responded to this point.

Second, according to the Examiner, the inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features. According to the Examiner the features which are common to all of the claims are: combined crankshaft and drive gear wheel which has been heat treated and has a carbide layer; however, the features common to all claims do not constitute "special technical features" since they do not make a "contribution" over the prior art.

Applicants respectfully point out that the special technical feature of the present invention is:

- both the crankshaft and drive gear wheel are ***cast*** (not forged) together as one piece,
- the crank shaft and gear wheel exhibit ***differential hardening*** (claim 4, line 3; claim 5, lines 2-3),
- both the crank shaft and gear wheel are manufactured from ***tempered ductile iron*** (***ADI*** – a cast iron with spherical graphite which, by targeted thermal treatment, exhibits improved wear characteristics); ADI being about 10% lower in weight than conventionally employed steel,
- the hardness of the gear wheel is further increased by at least one of (a) ***local differential thermal treatment*** during ADI heat treatment or (b) peening, and
- the friction wear resistance of the gear teeth is increased by application of carbide containing coatings (CADI) (e.g., into the melt to obtain an ADI microstructure with supplemental introduced carbides).

Hoyes ***forges*** a crankshaft with gear wheel ***without teeth*** and flange. Since the part is forged from SAE 1548 or SAE 1046 ***steel***, the gear teeth are not formed in the forging step, but rather must be cut into the gear wheel in a subsequent step. This necessarily precludes that any microstructure treatment imparted to the surface of the teeth for increased friction wear, as by introducing carbide into the melt or application of carbide coatings according to the present invention, remain intact.

Hoyes discloses a uniform heat treatment of the entire crankshaft, or induction heating of the gear wheel (apparently ***prior*** to cutting the gear teeth), but without the use of the tempered ductile iron (ADI), without the casting, without the integral forming of teeth, without the differential increased carbide in the gear teeth, thus Hoyes is far from the present invention.

Oyelayo discloses plasma treatment (sputtering) as an alternative to heat treatment. This treatment is non-selective for the entire part. Further, since sputtering acts on the entire piece, it is not even possible to carry out selective treatment.

There is no teaching within these references, and no technical reason known to the person of ordinary skill, as to why the teachings of these references could or should be combined, and even if combined, the product would be a uniformly treated part, not a part with increased hardness of a gear wheel of a crankshaft due to local differential thermal treatment or peening. From combining the teachings one would arrive only at parts which are uniformly treated.

Accordingly, the above listed same common special technical feature of the present invention

- being recited literally in claims 4, 5 and 6, and
- not being disclosed in or obvious over the prior art,

it follows that claims 3-6 are drawn to the same invention. Withdrawal of the Restriction Requirement is in order.

The Examiner next indicates that Applicant's election with traverse of claims 4-5 in the reply filed on 12/07 is acknowledged. Applicant explains that the special technical feature is differential hardening. This is not found persuasive because neither Hoyes nor Oyelayo et al teach the special technique feature of differential hardening.

Furthermore, it is noted that Group I is a product by process claim, which (see MPEP §2113) and the claims are limited only to the resulting structure of the process, where the resulting structure is the combined crankshaft and drive gear wheel that is hardened and has a carbide coating. ***The claims of Group II do not require differential hardening***, as argued by the Applicant, but instead only require that the device is hardened. It is clear that Group II fails to make a contribution over the prior art in light of Hoyes (WO 00/47362) in view of Oyelayo et al (2002/0098392). Since both groups do not share a "special technical feature" and there is no unity of invention between the two groups.

In response, Applicants point out that claim 6, like claims 4 and 5, requires <u>at least one of</u> <u>(a)</u> the heat treatment is controlled ***locally differentially*** such that ***locally the hardness is further increased***, or <u>(b)</u> the durability of the gear wheel is ***locally increased*** by peening, and that the friction wear resistance of the teeth of the gear wheel is increased by application of carbide containing coatings.

The local differential hardening, particularly combined with further improvement of friction wear resistance of the teeth of the gear wheel by introduction of carbide, is not taught in the cited combination of prior art.

Applicants respectfully submit that the claims, fairly read, all read on the same invention, and encompass the same special technical features.

Withdrawal of the restriction requirement and examination of claims 6 and 3 is thus respectfully requested.

Claim Rejections - 35 USC § 102

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoyes et al (WO 0047362) in view of Wilde et al (6,258,180), further in view of Oyelayo et al (2002/0098392).

According to the Examiner, Hoyes et al teaches a crankshaft with combined drive gear wheel, wherein crankshaft and gear wheel are hardened (see column 1 lines 21-22).

The limitations, "wherein the hardness of the gear wheel is further increased by local differential thermal treatment during ADI heat treatment and/or by peening, wherein both the crankshaft and drive gear wheel are cast as one piece" is being ***treated as a product by process limitation***. The Examiner does not see any difference between the product of claims 3 and 4, and the product of Hoyes et al.

Applicants respectfully traverse.

Hoyes ***forges*** a crankshaft with a round gear wheel, and must cut the gear teeth into the gear wheel after forging. This cutting into a forged surface results in a necessarily different surface microstructure than would be produced in accordance with the present invention where:

- both the crankshaft and drive gear wheel, with teeth, are ***cast*** (not forged) together as one piece,
- the crank shaft and gear wheel exhibit ***differential hardening*** (claim 4, line 3; claim 5, lines 2-3),
- both the crank shaft and gear wheel are manufactured from ***tempered ductile iron*** (***ADI*** – a cast iron with spherical graphite which, by targeted thermal

treatment, exhibits improved wear characteristics), ADI being about 10% lower in weight than conventionally employed steel,

- the hardness of the gear wheel is further increased by at least one of (a) ***local differential thermal treatment*** during ADI heat treatment or (b) peening, and
- the ***friction wear resistance of the gear teeth is increased*** by application of carbide containing coatings (CADI) (e.g., into the melt to obtain an ADI ***microstructure with supplemental introduced carbides – see claims 9 and 13***).

Hoyes ***forges*** a crankshaft with gear wheel ***without teeth***. Since the gear teeth are not formed in the forging step, but rather must be cut into the gear wheel subsequent to forging, any microstructure treatment imparted to the surface of the gear disk for increased friction wear, as by application of carbide coatings according to the present invention, prior to cutting teeth would not survive. Thus, Hoyes can not possibly suggest the present invention.

Hoyes discloses a uniform heat treatment of the entire crankshaft, or induction heating of the gear wheel (apparently ***prior*** to cutting the gear teeth), but without the use of the tempered ductile iron (ADI), without the casting, without the integral forming of teeth, without the differential increased carbide in the gear teeth. Hoyes thus at best hardens the gear wheel only, thus exhibits only two different areas of hardness.

In contrast, the crankshaft of the present invention will actually exhibit ***three*** different areas of hardening due to the recited steps, i.e., there are two different ADI steps, and one CADI step, resulting in three different areas of hardness. Thus Hoyes is far from the present invention.

According to the Examiner, Oyelayo discloses plasma treatment (sputtering) as an alternative to heat treatment.

Applicants respectfully traverse. This reference teaches ***coating***, not ***incorporating*** carbide into the alloy. Further, this reference does not teach the specific use of tempered ductile iron, a cast iron with spherical graphite with, by targeted thermal treatment (tempering), exhibits improved wear characteristics.

The Oyelayo treatment is non-selective and is applied to the entire part. There is no way to use the method of Oyelayo to selectively harden only gear teeth. Further, since sputtering acts on the entire piece, it is not even possible to carry out selective treatment. Further, the process

involves forming a first layer of, e.g., boron carbide, a second layer of, e.g., a mixture of boron carbide and boron oxide, and a third layer of, e.g., boron oxide. There is no mention of heat treatment such that the carbide is introduced into the microstructure of the alloy, and in particular ADI, as in the present invention.

There is no teaching within these references, and no technical reason known to the person of ordinary skill, as to why the teachings of these references could or should be combined, and even if combined, the product would be a uniformly treated part, not a part with increased hardness of a gear wheel of a crankshaft due to local differential thermal treatment or peening. From combining the teachings one would arrive only at parts which are uniformly treated.

Accordingly, the above listed same common special technical feature of the present invention

- being recited literally in claims 4, 5 and 6, and
- not being disclosed in or obvious over the prior art,

it follows that claims 3-6 are drawn to the same invention. Withdrawal of the Restriction Requirement is in order.

The Examiner next indicates that Applicant's election with traverse of claims 4-5 in the reply filed on 12/07 is acknowledged. Applicant explains that the special technical feature is differential hardening. This is not found persuasive because neither Hoyes nor Oyelayo et al teach the special technique feature of differential hardening.

Furthermore, it is noted that Group I is a product by process claim, which (see MPEP §2113) and the claims are limited only to the resulting structure of the process, where the resulting structure is the combined crankshaft and drive gear wheel that is hardened and has a carbide coating. ***The claims of Group II do not require differential hardening***, as argued by the Applicant, but instead only require that the device is hardened. It is clear that Group II fails to make a contribution over the prior art in light of Hoyes (WO 00/47362) in view of Oyelayo et al (2002/0098392). Since both groups do not share a "special technical feature" and there is no unity of invention between the two groups.

In response, Applicants point out that claim 6, like claims 4 and 5, requires at least one of (a) the heat treatment is controlled ***locally differentially*** such that ***locally the hardness is***

further increased, or (b) the durability of the gear wheel is ***locally increased*** by peening, and that the friction wear resistance of the teeth of the gear wheel is increased by application of carbide containing coatings.

The local differential hardening, particularly combined with further improvement of friction wear resistance of the teeth of the gear wheel by introduction of carbide, is not taught in the cited combination of prior art.

The Examiner next concedes that Hoyes et al fail to teach wherein the crankshaft and drive gear wheel are manufactured from tempered ductile iron (ADI) and have a carbide containing coating (CADI).

Wilde et al is cited for teaching ***producing a crankshaft*** out of an austempered ductile iron (see column 2 lines 55-60, where it discloses producing crankshafts, and see column 4 lines 4-12). Oyelayo et al is again cited for teaching a carbide coating deposited on gear teeth..

Applicants respectfully traverse.

This reference simply teaches that ductile iron castings are widely used in the automotive industry for crankshafts, camshafts, steering knuckles, pinions, gears, and many other components, and for a variety of machinery applications, marine applications, and equipment used in the paper and glass industries. However, primary iron carbides in ductile iron castings are normally quite ***detrimental*** as they reduce the machinability, ductility and impact properties. One recent approach has been the use of austempered ductile iron (hereinafter referred to as "ADI"). Although ADI represented a significant step toward finding a satisfactory solution for this problem, the abrasion characteristics (e.g., wear resistance) of the tines produced with ADI were not completely satisfactory. a cast iron component that has undergone an austempering process is comprised of primary iron carbides ***uniformly*** dispersed throughout a substantially ausferritic matrix. Thus, there is no teaching of ***surface*** treatment, particularly of treatment of the ***gear wheel only,*** and most specifically, of the ***teeth only*** (claims 9 and 13), of an article which is a combination crankshaft and gear wheel.

Applicants have carefully reviewed the three cited references and find therein no motivation to combine the references to reach the present claimed structure.

Accordingly, withdrawal of the rejection is respectfully requested.

The Commissioner is hereby authorized to charge any fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

Respectfully submitted,

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